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PTO 03-3436

CY=JA DATE=19920402 KIND=A
PN=04-100338

DATA TRANSMISSION CHECKING SYSTEM
[Densodata no chekku shisutemu]

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UNITED STATES PATENT AND TRADEMARK OFFICE
Washington, D.C. May 2003

Translated by: FLS, Inc.

PUBLICATION COUNTRY (10): JA

DOCUMENT NUMBER (11): 04-100338

DOCUMENT KIND (12): A

(13): PUBLISHED UNEXAMINED PATENT APPLICATION (Kokai)

PUBLICATION DATE (43): 19920402 [WITHOUT GRANT]

PUBLICATION DATE (45): [WITH GRANT]

APPLICATION NUMBER (21): 02-217819

APPLICATION DATE (22): 19900817

PRIORITY DATE (32):

ADDITION TO (61):

INTERNATIONAL CLASSIFICATION (51): H 04 L 1/00; H 04 Q 9/00

DOMESTIC CLASSIFICATION (52):

PRIORITY COUNTRY (33):

PRIORITY NUMBER (31):

PRIORITY DATE (32):

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TITLE (54): DATA TRANSMISSION CHECKING SYSTEM

FOREIGN TITLE [54A]: Densodata no chekku shisutemu

Specification /2*

1. Name of this invention

Data Transmission Checking System

2. Claims

[1] Data transmission checking system equipped with a transmission means (10) that adds an identical non-recurring data (Dp) to the starting record (Rt) and ending record (Rb) of transmitting data (Ds) and a signal reception means (20) that validates the equality of the non-recurring data (Dp) in the starting record (Rt) and non-recurring data (Dp) in the ending record (Rb).

3. Detailed Explanation of this Invention

[Summary]

This invention pertains to a data transmission checking system that validates data transmission between electronic apparatuses. The purpose of this invention is to provide a data transmission validation system that can detect a transmission error when a required number of data are not successfully transmitted during the transmission process due to transmission errors.

This invention provides a data transmission checking system equipped with a transmission means (10) that adds an identical non-recurring data to the starting record and ending record of the transmission data and a signal reception means that validates the

* Numbers in the margin indicate pagination in the foreign text.

equality of the non-recurring data in the starting record and non-recurring data in the ending record.

[Industrial Field]

This invention pertains to a data transmission checking system for transmitting data between electronic apparatuses and is particularly associated with a data transmission checking system used for validating the data necessary for mounting parts onto a printed wired board.

[Conventional Technology]

A mounting device used to mount parts onto a printed circuit board requires various data (e.g., type, location, direction, etc.) of the parts determined during their designing phases. Those data are transmitted via a cable by selecting applicable data from numerous data stored in a device such as main memory of a host computer. /252

Figure 3 is a conceptual diagram of a data transmission network designed to transmit data from a host computer to part-mounting devices. As shown in the figure, a signal transmission means **10** is comprised of a host computer **1** equipped with a main memory **9** and serial loop controller **3** that controls data transmission via the network consisting of multiple part-mounting devices **2** that are serially connected to form a loop (part-mounting devices are designated by 'a' and 'b' in the figure to indicate their plurality and individualities.)

Each part-mounting device **2** is equipped with a signal reception means **20** comprising a MPU 4 that receives and controls data transmitted from the host computer **1** and memories **5** in which data transmitted from the host computer **1** is stored (memories are designated by 'a' and 'b' in the figure to indicate the plurality and individualities.)

Figure 4 is a flowchart showing the data transmission sequence within the network configured as described above. The data requested by the main memory 9 of the host computer **1** is read according to the data creation instruction (S11 in Fig. 4) transmitted from an operational board at the signal reception means **10** and temporarily written to the work memory **11** equipped in the host computer (F11 in Fig. 4). The data in the work memory is converted into a format suited to the part-mounting device **2** and processed accordingly (e.g., total transmission count is written at the first record of the data; a sequential number is added to each data (F12 in Fig. 4). At the completion of data creation process, the signal reception means **20** is notified (F13 in Fig. 4). Once the signal reception means **20** issues a transmission permission (S12 in Fig. 4), data is transmitted to the signal reception means **20** via the serial loop controller **3** and stored in the memory **5** of signal reception side.

The signal reception means **20** receiving the data must validate the data. If a method that adds the total transmitted data count to the first record is used to validate the data transmission, the

signal reception means **20** compares the total number of data transmission with the actually received data count. If a method that assigns a sequential number to each data is used, the signal reception means **20** checks each record number to verify the accuracy of number sequence to validate the data (F14 → F15 in Fig. 4).

Also, in addition to the error checking methods described above, both the total transmitted data and sequential data number may be used for checking the transmission by adding a total transmission number to the first record and placing a sequential data number to each data.

As another alternative, the data transmission is designed to transmit the same data group twice in order to compare the first and second data groups (double transmission method). In this case, if both data groups are identical, the probability of accurate data transmission is high; on the other hand, if both groups are not identical, the probability of transmission error is high.

Checking the transmitted data is not limited to the data sent via a cable, as such checking is also performed on the file transmission. Figure 5 is a diagram showing the concept of data file transmission conducted in an environment of multi-task OS. The host computer **1**, that can simultaneously perform multiple tasks, stores the data associated with the result of each task to the main memory **9**. When a data transmission request is issued from a low priority task (e.g., printer **6**), the requested data is read from the main

memory **9** and temporarily written in the middle memory **8** where the data is processed to a printing format and transmitted to the printer **6**. The host computer **1** performs operations for other task-requests after transmitting the data to the middle memory **8** and is never completely occupied by the printing task.

To validate the data file transmission, the same transmission checking methods described above are used to validate the accuracy of data transmitted from the host computer **1** (called 'foreground') to the printer **6** (called 'background').

[Problems to Be Solved by this Invention] /253

The problem with the sequential data number checking method shown in Fig. 4 is that, for example, when ten data had been transferred to the memory **5** of the signal transmission means **20**, and during the next transmission for sending a total of eight data, only three data could be transmitted to the memory **5** due to transmission error. In this case, since the valid continuity exists between the last data number of previously transmitted data stored in the memory and the newly transmitted data sequence numbers, a transmission error cannot be detected by only verifying the sequential number assigned to each data.

On the other hand, in the case of a method verifying a total transmission count or total transmission count/data sequence number, when a number of previously transmitted data is 10, and a number of newly transmitted data is also 10, if only three data could be

successfully transmitted due to an error, the data transmission error cannot be detected.

If this happens, when the data reception side is a part-mounting device **2** receiving part-mounting data for a substrate, the fourth and succeeding data remaining from the previous transmission are not accurate data for the current substrate. Also, if a double transmission method is used to check the transmission error, although possibility of successful error detection is high, data transmission time becomes much longer.

This invention was developed to solve those problems. The purpose of this invention is to provide a transmitted data checking system that can successfully detect a transmission error when a required number of data cannot be transmitted due to transmission problems.

[Method to Solve the Problems]

To achieve the purpose described above, this invention provides a data transmission checking system equipped with a transmission means (10) that adds an identical non-recurring data (Dp) to the starting record (Rt) and ending record (Rb) of transmitting data (Ds) and a signal reception means (20) that validates the equality of the non-recurring data (Dp) in the starting record (Rt) and non-recurring data (Dp) in the ending record (Rb).

[Operation]

With the configuration as described above, non-recurring data **Dp** written onto the starting record **Rt** and ending record **Rb** are compared by a signal reception means **20**, and if they do not match, the data transmission can be considered as an error.

[Operational Example]

Figure 1 is a diagram showing the concept of this invention. Figure 2 is a flowchart of an operational example of this invention. Although the device configuration is identical to the conventional device shown in Fig. 3, the operational sequence differs as described below:

When a data creation command is sent to the signal transmission means **10** from the operational board of signal reception means **20** (S1 in Fig. 2), the host computer **1** holds the non-recurring data (e.g., current date/time) to a specific internal register, extracts the specified data from the main memory **10**, and write the data to the work memory **11** (F1 → F2 in Fig. 2).

The data written onto the work memory **11** is processed for MPU 4 of the signal reception means. At the completion of data creation process, a creation termination signal is sent to the signal reception means **20** (F3 → F4 in Fig. 2).

The signal reception means **20**, which has received the creation termination signal, transmits a data transmission command from the operational board (S2 in Fig. 2), operates the serial loop controller

3, and starts transmitting data (F5 in Fig. 2). Then, after the date/time data held at said register **12** is read, the data in the work memory **11** is read, and date/time data held at said register **12** is read. Those data are sequentially transmitted to the signal reception means **20**, forming the transmission data **Ds** shown in Fig. 1. When the data extracted at data extraction processing step (F2 → F4) is written to the work memory **11**, non-recurring data **Dp** may be written to the starting record Rt and ending record **Rb**, and the content in the work memory **11** may be sequentially read at the time of data transmission. /254

The signal reception means **20** first holds the non-recurring data (data/time data) **Dp**, which is the content of first transmission record **Rt**, in a register (not shown in the figure) and stores the data related to the parts to a high capacity memory **5**. When the final record **Rb** is transmitted, the first non-recurring data **Dp** and final non-recurring data **Dp** stored in the registers are compared (F6, F7, and F8 in Fig. 1).

With this technique, the result of error checking is determined based on the matching/non-matching result of compared data.

Although an example described above used a cable for data transmission, this invention can be applied to data file transmission under a multi-task OS environment.

[Effectiveness of this Invention]

As explained above, this invention inserts an identical non-recurring data to the first record and last record and compares the first record and last record at the time of data reception to confirm the equality of those data. Therefore, when a required number of data cannot be transmitted due to transmission problem, the transmission error can be successfully detected.

4. Simple Explanation of the Figures

Figure 1 is a diagram showing the concept of this invention. Figure 2 is a flowchart of an operational example of this invention. Figure 3 is a conceptual diagram of a net system designed to transmit data from a host computer to a part-mounting device. Figure 4 is a flowchart showing the data transmission sequence. Figure 5 is a diagram showing the concept of data file transmission.

In the figures:

Ds…Transmission data; Rt…First record; Rb…Last record; Dp…Non-recurring data

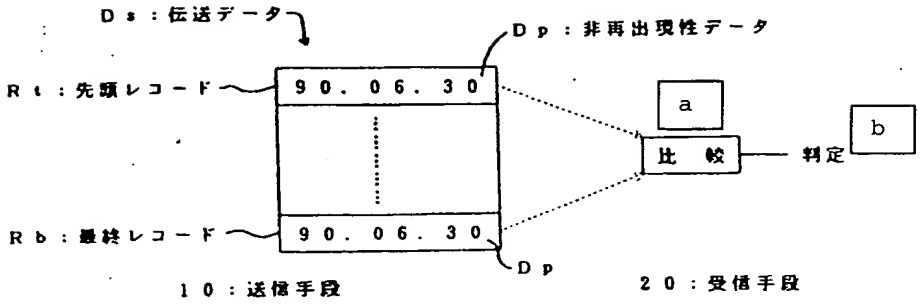

Figure 1

10…Signal transmission means; 20…Signal reception means
Key: a-Comparison; b-Determination

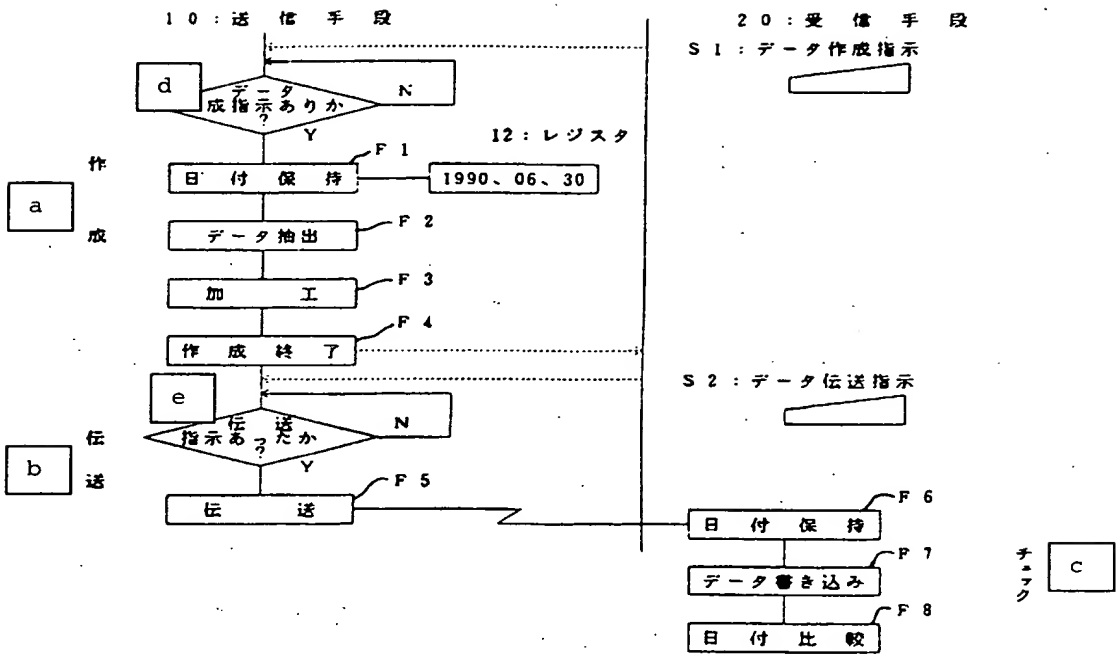

Figure 2

10…Signal transmission means; 12…Register; 20…Signal reception means; S1…Data creation command; S2…Data transmission command; Step F1…Hold date/time; F2…Extract data; F3…Process; F4…End of creation; F5…Transmission; F6…Hold date/time; F7…Write data; F8…Compare date/time data

Key: a-Creation; b-Transmission; c-Checking; d-Data creation command exists?; e-Transmission command exists?

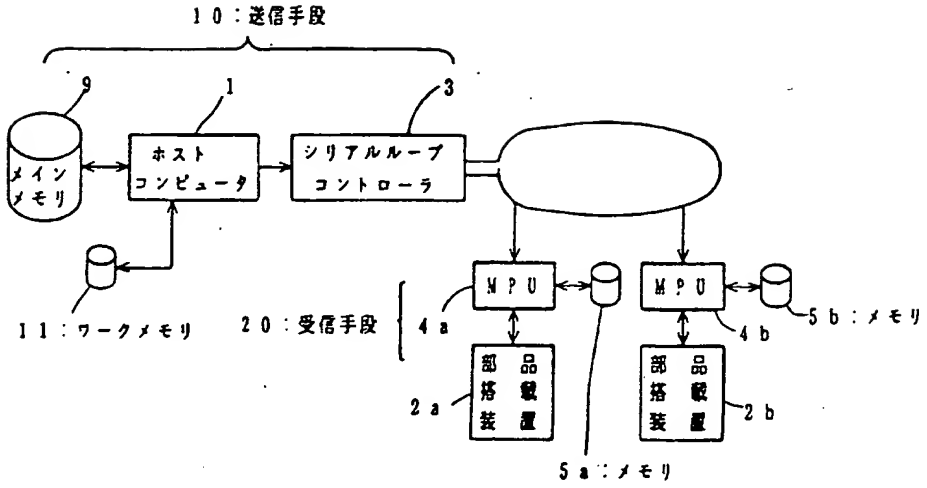

Figure 3

1…Host computer; 2a, 2b…Part-mounting device; 3…Serial loop controller; 5a, 5b…Memory; 9…Main memory; 10…Signal transmission means; 11…Work memory; 20…Signal reception means

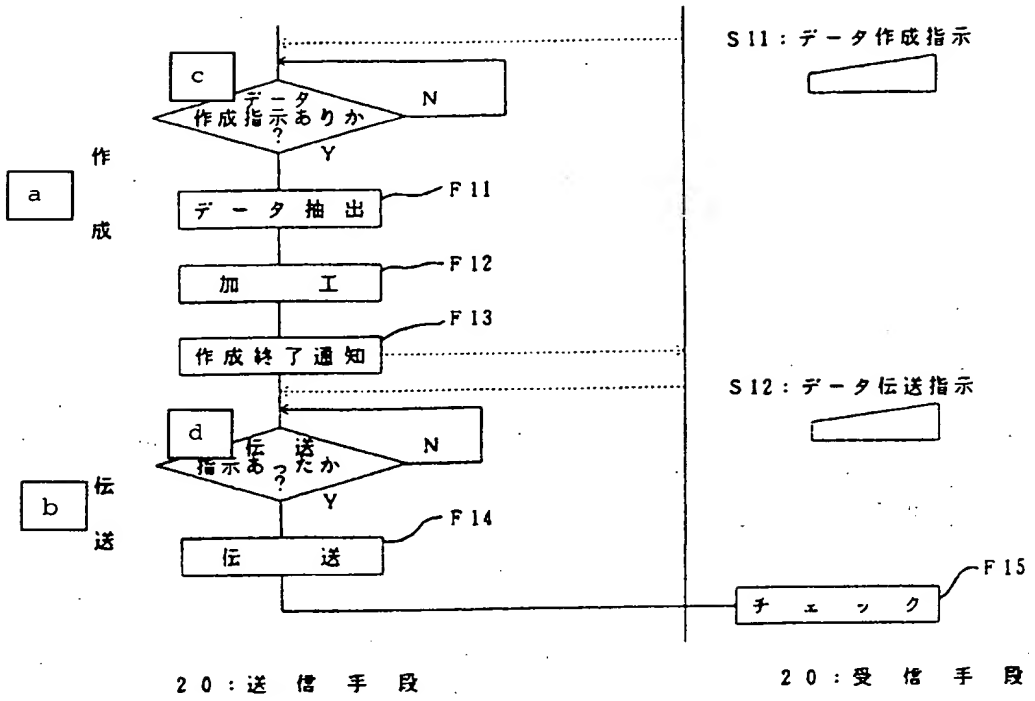

Figure 4

10…Signal transmission means; 20…Signal reception means; S11…Data creation command; S12…Data transmission command; Step F11…Extract data; F12…Process; F13…End of creation; F14…Transmission; F15…Check
Key: a-Creation; b-Transmission; c-Data creation command exists?; d-Transmission command exists?

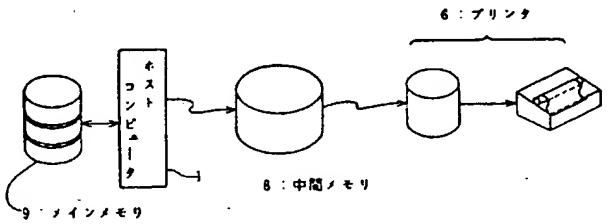

Figure 5

1…Host computer; 6…Printer; 8…Middle memory; 9…Main memory